CHAPTER 6
INLETS / STORM SEWERS / MANHOLES

6.1 Design Criteria

6.1.1 General

The primary objective of street drainage design is to limit the amount of water flowing along the gutters or ponding at the low points to quantities that will not interfere with the passage of traffic for the design frequency. This is accomplished by placing inlets at such points and at such intervals to intercept flows and control spread.

6.1.2 Curb Inlets

Curb inlets used for street drainage shall be designed as follows:

- Space inlets on grade to limit the spread of water as follows, based on an intensity of 4 inches per hour:
  - Local streets – ¾ of the driving lane
  - Collector streets – ½ of the driving lane
  - Arterial streets – 4 feet in the driving lane
- The depth of water in a sag shall be limited to the
  - Top of curb using an intensity of 4 inches per hour
  - Back of sidewalk using an intensity of 6.9 inches per hour (100 year storm with a 10 minute time of concentration)
- Space inlets to prevent concentrated water from flowing across the road
- Place inlets on the upstream side of intersection radii
- Design the inlet assuming flow only through the curb opening, if a grate is present
- Provide an overflow channel assuming that inlets in low points are 50% obstructed. The channel shall be designed to carry the portion of the 100-year storm that does not enter the inlets.

6.1.3 Surface Inlets

Surface inlets in grassed areas, parking lots, and roadside channels shall be designed as follows:

- Inlets in grass areas shall be constructed in a sump condition so that the top elevation of the berm around the inlet is at least 1 foot above the 100-year storm elevation.
- Limit the depth of water for the 100-year storm to at least 2 feet below the elevation of the lowest opening of adjacent structures.
- Provide a clear path for water to flow overland to a channel or the street assuming that inlets in low points are obstructed.
- For roadside channels, limit the depth of water to the edge of pavement or sidewalk, whichever applies, for the 100-year storm.

Surface inlets shall not be used within a roadway for street drainage.

6.1.4 Storm Sewers

Storm sewers shall be designed as follows:

- Size the pipes to flow under gravity (not under pressure) for the 10-year storm.
- Size the pipes so that overflows at inlets and manholes do not occur for the 100-year storm.
- Use a minimum pipe size of 15 inches.
- Use open channels for flows greater than 100 cfs for the 100-year storm.
- Limit the cumulative discharge from storm sewers in a 200 feet section of channel to less than 100 cfs, calculated for the 100-year storm.
- Provide a minimum slope of 0.5%
- Provide a minimum velocity of 3 feet per second at full flow.
- Provide a minimum cover of 18 inches.
- Construct storm sewers of reinforced concrete pipe.

Outfalls shall be extended to the rear property line in residential developments where possible.

Streams that are part of the waters of Fayette County shall not be routed to flow through storm sewers.

Storm sewers shall not be used to channel flows from areas upstream of a development unless the 100-year peak flow is less than 100 cfs.

6.1.5 Manholes

- Place manholes at the following locations:
  - where 2 storm sewers intersect
  - at changes in pipe size
  - where the slope changes
  - where horizontal alignment changes
- Space manholes no more than 300 feet apart for pipes 42” diameter or less, and no more than 400’ apart for pipes 48” diameter and larger
- Match the crown line of the upstream pipe to the crown line of the downstream pipe

6.1.6 Passthrough Drainage

Runoff from off-site areas shall be evaluated based on future land use as shown in the Comprehensive Plan. Pass through systems shall be designed for the 100-year storm. The upstream area shall be assumed to have detention unless it is exempted as described in Chapter 1.

6.2 Inlet Design Procedures

6.2.1 Curb Inlets on Grade

Use a software program based on the hydraulic methods used by the KYTC or FHWA for highway drainage. For more information, go to the FHWA Urban Drainage Design Manual (HEC22).

6.2.2 Curb Inlets in Low Points

Use the weir flow equation for depths less than or equal to the curb opening.

$$Q = CLd^{1.5}$$

where:
Q = flow in cfs
C = 3.0
L = curb opening length (ft)
d = depth of water at curb measured from the normal cross slope gutter flow line (ft)

Use the orifice equation for depths greater than the curb opening.

$$Q = CA(2gd)^{0.5}$$

where:
Q = flow (cfs)
C = 0.67
A = clear area of opening (ft^2)
d = head on center of opening (ft)
g = 32.2 (ft/sec)

6.2.3 Surface Inlets

Use the weir flow and orifice flow equation to compute flow through the grate:

For $d \leq 0.4$', use the weir flow equation:

$$Q = C\,Pd^{1.5}$$

where:
Q = flow in cfs
C = 3.0
d = depth of water in feet
P = perimeter of the grate in feet

For $d \geq 1.0'$, use the orifice flow equation:

$$Q = CA\sqrt{2gd}$$

where:
C = 0.67
A = clear opening area of the grate (ft^2)
g = 32.2 ft/sec
d = depth of water in feet

For $0.4' < d < 1.0'$, compute the flow using both the weir flow and orifice flow equations. Use the smallest flow for a given depth.

6.3 Storm Sewer Design Procedures

Use a software program based on the hydraulic methods used by KYTC or FHWA for highway drainage.

6.4 Construction Specifications

All storm drainage structures, including storm sewer pipe, curb box inlets, surface inlets, culvert pipe, and manholes, shall be installed in accordance with the LFUCG Standard Drawings and the KYTC Standard Specifications for Road and Bridge Construction, latest edition.